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ILLINOIAN GLACIATION IN KILLBUCK VALLEY SOUTH OF MILLERSBURG, OHIO

GEORGE D. HUBBARD

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INTRODUCTION

Location.—The area under consideration is in Holmes County from 65 to 75 miles south of Cleveland along Killbuck Creek south of Millersburg. Millersburg is made a place of reference because the southern boundary of Late-Wisconsin drift runs essentially east and west very near the city. East of town the boundary can be located very accurately on the topographic map, Millersburg sheet, of the Geologic Survey by the difference in the topography shown there. West, the difference is not so marked but recognizable.

In the field the difference between the topography north and south of the line is as obvious as is the presence and absence of foreign boulders on opposite sides. Wisconsin outwash, if ever laid in the Killbuck valley immediately below Millersburg, has been either removed or covered by the alluvium which now mantles all on the flood-plain level.

The main point.—Special interest attaches to the data in this paper because they describe Illinoian drift and outwash occurring for several miles down the valley beyond the Late Wisconsin deposits. The paper does not locate the main Illinoian ice border because that must be beneath the younger drift. Illinoian ice, however, is believed to have extended as a valley dependency of the ice lobe, farther south in the valley than the Wisconsin front.

DESCRIPTION OF MORAINE

General.—Illinoian outwash in Killbuck valley below Millersburg has long been known, but Illinoian drift has only recently been found. Sliding boulders on most slopes of the main valley here testify to the fact that no ice erosion has taken place on the upper slopes. Total absence of foreign pebbles and boulders on these upper slopes witnesses to the same thing.

Deposits of Illinoian drift.—(1) Two miles below Millersburg (Fig. 1) on the west side of the valley, a small, old family cemetery occupies a drift hill that clings to the valley wall and maintains moraine form. According to the topographic map the cemetery is between 980 and 1000 feet above sea level and about 100 feet above the large gravel terrace in the valley below. One foreign boulder of about 300 pounds weight was found in the little sag between the drift hill and the valley wall, and another of about 200 pounds weight nearly buried in drift was found on the north slope of the hill. Below the cemetery at altitudes of 930 feet to 940 feet are a number of small foreign fragments, and still lower toward the road ledges of bed rock outcrop. The sag between the drift hill and the rock valley wall is considered characteristic of ice deposition, an argument that the drift hill upon which the cemetery rides is morainic.

(2) About one-third of a mile south of the cemetery and up a tiny run from the main valley is a typical, conical hill, a kame with conical bedding, opened for gravel and sand, large enough to be operated by machinery. This gravel and many pebbles in a till area near the kame are weathered enough to be Illinoian. The hill top is about 920 feet and all the gravel and Illinoian till are above the great Illinoian outwash terrace in the main valley below.

(3) Again a half mile south of (2) above the road, hence 20–30

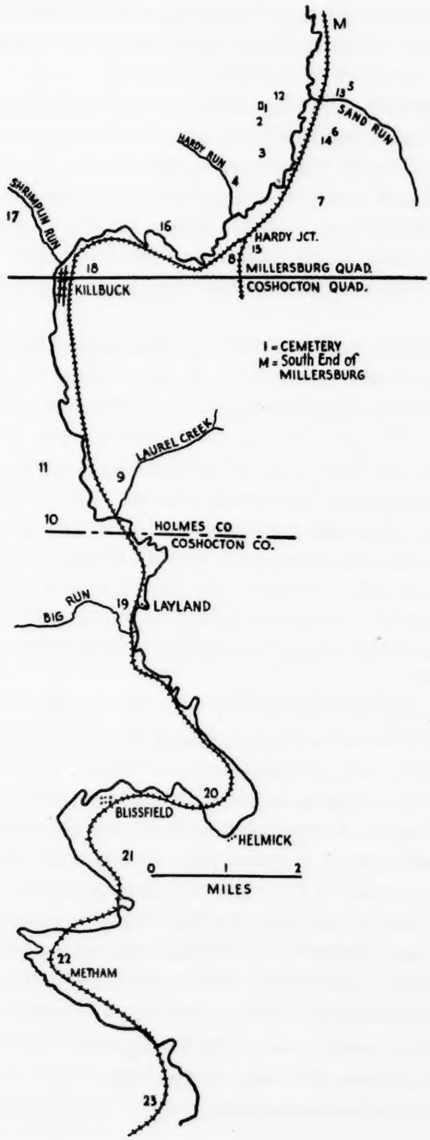

FIG. 1. Distribution of drift deposits (1)-----(11), of outwash (12)-----(23).

feet above the large terrace, is a hummock of typical old till with foreign pebbles. This moraine form has some washed, rounded gravel, but no pebbles were found above it.

(4) In the mouth of Hardy Run nearly a mile south of (3) is a ridge of Illinoian moraine 50 feet or more above the Illinoian terrace and 930 feet or more above sea level. Many pebbles of foreign rock, 1 to 4 inches through, were found and one red granitic rock a foot through was noted. Some 1,500 to 1,800 feet northeast along the main valley wall is another hummock of similar old drift. These bits of moraine rest on the gently rising bed-rock valley wall.

(5) Turning now to the east side of Killbuck valley, several more evidences in moraine are found. In Sand Run up the north side of the little valley to altitudes of over 960 feet, foreign pebbles are common; drift patches but no moraine forms were identified. Mantle is thin and bed rock often shows through. Some of the drift here is fresh like Wisconsin and much Wisconsin is known up Sand Run. Enough weathered pebbles, however, were found to warrant listing this place as a site of Illinoian drift.

(6) Nearly a mile south of the latter site a terrace of fairly well-sorted gravel and sand is found at contour 880; 30 to 40 feet above the top of the terrace is a distinct moraine form with foreign pebbles in drift.

(7) A mile south of the last (6) and nearly opposite Hardy Run there is a small unnamed run. A trail of drift hangs on the ledges along the north side of this Run. This drift is rich in foreign pebbles but the deposit is till and not outwash and reaches as high as 900 feet. A careful search above the deposit disclosed only one foreign piece, a greenstone weathered 8 inches deep and exposed 100 feet above the road which is at contour 940.

(8) A mile and a half down valley near the mouth of the second ravine is the next deposit. A trailing form of gravelly drift adorns the north side of the lateral valley attaining altitudes about 870 feet. It contains many foreign pebbles. No outwash was found here in the main valley, nor were foreign pebbles found above the moraine; but above 900 feet begin large local boulders of float coming down from ledges above.

This series of drift deposits thus extends between three and four miles south of Millersburg and the Late Wisconsin drift border.

(9) About four miles farther south, below the village of Killbuck at the mouth of Laurel Creek is a striking deposit of sandy, gravelly till with much foreign material. The deposit reaches 885 to 890 feet and extends half across Laurel Creek valley, trailing southeastward from the north wall of the valley; it may have been part of a loop of moraine across the main valley. It is much higher than the large Illinoian outwash deposits across the main valley.

(10) Above the outwash on the west side are two hills that look very morainic. They consist of till and are about 40 feet above the plain and somewhat above well-recognized outwash in the valley.

(11) A mile farther north and straight west of the large drift form at (9) is a gravelly drift deposit clinging to the rock wall of the valley but showing a distinct sag between itself and the valley wall. It is higher than outwash of the valley and a little higher than the moraine at (10). There is doubt about the moraine interpretation for the last three because they are so far down valley, but their form and composition as well as position argue for it.

DESCRIPTIONS OF OUTWASH DEPOSITS

General.—Outwash down Killbuck Valley has long been known. Two questions have been raised concerning it. Where was the ice front when outwash was laid? Was there ice in the valley so that moraine terraces were built, of which the gravel terraces are remnants, or was the gravel laid entirely across the valley and subsequently mostly eroded?

Deposits described.—(12) The first deposit to be described is a mile or two south of Millersburg on the west side of the valley. It constitutes a terrace nearly two miles long, and about one-third mile wide, with an altitude of 880 to 885 feet or about 75 feet above the valley floor. The terrace front is a steep slope without cusps or crescentic erosion forms or subordinate terraces. The front is remarkably smooth and even and only notched by

sharp ravines made by post-Illinoian erosion. In places the surface has considerable over-burden of poorly sorted, tan-colored waste which is more clayey than the main body of the terrace. A 10-foot sag extends much of the length between valley wall and terrace but it is largely erosional, made by water that runs down the valley wall to terrace. The southern end of this terrace has been extensively machine-worked for gravel. Screening has separated a number of boulders, the largest of which are about four feet through. Some beds here exposed are strongly cemented.

(13) On the opposite side of the valley at the mouth of Sand Run, is a great pile of screened sand and gravel (pea-size down) heaped up for sale. Approximately one third of the pebbles from pea-size up that have been screened out are foreign. This material is outwash, not drift and not simply flood plain. No doubt some of this gravel is Wisconsin, for Sand Run is known to have carried Wisconsin drainage. The flood plain between this deposit and the last is of recent, poorly sorted alluvium deposited by choked drainage during the past century.

(14) Nearly a mile south of Sand Run in the mouth of a short ravine is a remnant of very well sorted outwash shielded here from erosion.

(15) About two miles farther down this valley wall, preserved around a spring in the mouth of a little run, is a deposit rising to the altitude of 850 to 855 feet: foreign pebbles are frequent. Rock slopes are steep and probably a large proportion of the deposit has been removed.

(16) Across the valley and two miles below the large terrace is a much dissected form whose level summits are at about 860 to 865 feet. On its down-stream slope is a lower second terrace, but neither terrace has cusps or characteristic stream-carved crescentic patterns. The upper one is opened for gravel but sorting is poor and over-burden 2 to 4 feet thick, hence working has been abandoned. Weathering of pebbles and dissection of form indicate Illinoian age. Here over-burden as usual is interpreted as flood-plain waste laid after true outwash ceased and before erosion of gravels began.

(17) The terrace at the mouth of Shrimplin and Black creeks

consists of good Illinoian outwash gravel and sand, has a surface elevation of 860 to 880 feet with an area of nearly one square mile. The railroad cut along its south side exposed bed rock in a little point of the terrace, which seems to be the top of a rock remnant, left by stream erosion between the two creeks and buried by outwash deposition. A little similar outwash found at about the same level up both creeks above this terrace is believed to be material washed in from the Killbuck valley rather than washed down the creeks, though Shrimplin has foreign gravel all the way to its sources, which are at the Wisconsin drift margin. While the terraces are all about the same height near the mouths, the deposits up stream are graded to the present stream.

(18) A large terrace of Illinoian outwash extends along Killbuck valley back of Killbuck village. It has a length of nearly two miles and an altitude of 880 feet and has been partly separated from the valley wall by erosion. Extensive working of the southern part exposes excellent sorting, cross bedding, some strong cementation, and occasional boulders up to a foot or more in diameter.

(19) At Layland more than 4 miles below Killbuck village is a gravelly Illinoian outwash terrace at 860 feet (Locke level). A valley, partly erosional 15–20 feet deep at maximum, runs between the rock valley wall and the terrace, and sliding blocks of local sandstone are strewn along the wall from near the terrace top up to outcrops near the top.

(20) Nearly three miles farther down stream at Helmick Station the Illinoian outwash terrace is about 850 feet altitude, but the terrace front is stream cut into three steps with crescentic and cuspate fronts.

(21) A mile below Blissfield is a broad two-step terrace of good Illinoian outwash, opened and worked in several places. Summit level is about 850 feet.

(22) At Metham the outwash terrace is about 840 feet high, has no steps and only one cusp on its front. It too has been worked.

(23) About three-fourths mile above Bantum School is the last Killbuck valley terrace. It is made of Illinoian outwash, and is

not over 825 feet high with no terrace steps; its sands are used for cement blocks.

Up Doughty and Wolf creeks are gravel terrace remnants like those already noted along Black and Shrimplin, which correspond in height with those in Killbuck and are interpreted to be material set back into these laterals as Killbuck was aggraded, but they have no foreign pebbles above the terraces because they do not reach back to the ice front.

Coshocton, six or seven miles below the last terrace noted on Killbuck and at the junction of Walhonding and Tuscarawas rivers, spreads over an Illinoian outwash terrace whose top is about 800 feet high.

DISCUSSION AND CONCLUSIONS

The drift.—For more than twenty five years the author has known of scattered evidence of this Illinoian glaciation. Conversation with some of the Ohio geologists of those early years brought only expressions of doubt and assertions of the impossibility of such a condition. Only recently has it been possible to make a thorough examination of this valley. The findings have been discussed with the state geologist and are believed to be in harmony with other recent findings in Ohio.

The remnants of drift are so distributed as to make it impossible to believe that there was ever a continuous sheet of till over the hills as far south as drift is found in Killbuck valley. Nor is it possible to believe that the Illinoian ice covered the hills adjacent to the valley as the Late Wisconsin did farther north. Foreign pebbles, boulders and drift were not found above the altitudes mentioned in the descriptions, never over 1000 feet and only at less altitudes toward the south. Further, the detached masses of sandstone creeping down all slopes above the drift remnants, but not below, witness to the absence of ice erosion over the tops and upper slopes of the hills. The upper resistant layers of sandstone in the hills are continually contributing these detached float rock masses to creep their way down. In valleys never glaciated they may be found all down the slopes and out on the flood plains, but not so in Killbuck as far south as the drift is found.

The drift, like the outwash in the terraces, is much weathered. Foreign pebbles are weathered far too much to be Wisconsin pebbles of any age.

The Illinoian ice.—Since the ice was limited to the valley from Millersburg south to Laurel Creek, a distance of seven to eight miles, it is believed that a tongue of ice, a valley dependency, stretched down this valley from the general Illinoian ice margin. That margin must have been a short distance north of the Late Wisconsin margin because the old drift is not exposed on the hills on either side of Killbuck valley. The surface slope of the ice tongue southward was not alpine but a matter of less than 200 feet in the seven to eight miles. Killbuck valley was probably deeper then than now for the stream does not flow on rock. Valley filling is known to be 150 feet deep near Millersburg, as shown in city waterworks wells.

No evidence was found that Killbuck valley had a dependency in it in Wisconsin time. The shallowness of the valley at that time may have been one reason for this absence.

Illinoian outwash.—The gravels and sands of the terraces are weathered very much more than the Wisconsin outwash found in great quantities at Brinkhaven. The terraces are usually dissected by stream work, whereas terraces in Wisconsin outwash are not much cut up. For these reasons the terraces described above are called Illinoian.

Search was made for stream-carved patterns on terrace fronts and for evidence that the terrace fronts were built against ice. The fact that terraces occasionally occurring on opposite sides of the valley are at essentially the same height seems to indicate a fill entirely across the valley and not a narrow fill on each side against the ice. The remnants of terrace tops descend rather uniformly down stream. Tumbled stratification in the edges of the terraces, if. present, might indicate collapse of marginal gravels when ice melted, but none was found. On the other hand, four of the remnants have recognizable, terrace steps, cusps, or crescentic curved fronts as if stream-carved. Some lack all these characteristics; but in the face of all the evidence it is believed that Illinoian outwash filled the valley entirely across to the level

of the great terrace tops and that post-Illinoian stream erosion removed all but the present remnants. Gravel and sand, some of which are cemented and weathered, are known beneath alluvium in several places in the present valley floor. These materials are believed to be Illinoian also.

Not a single deposit of fresh gravel that might be Wisconsin has been found in the valley. It seems probable that in accord with the wealth of Wisconsin moraine up valley there must have been outwash taken down the valley, but apparently it was completely removed before the recent alluvium was put in place. While slopes were cleared and cultivated, no attention was given to the creek in the valley; and it was thus unable to remove waste and water fast enough to prevent the choking which induced marsh conditions. Marshes here are not full of peat as they are in many valleys where lakes were formed. The marsh conditions are recent.

Summary.—Killbuck valley is preglacial. In this section it is not clear which way its preglacial stream flowed, but in all probability it went southward past Millersburg. The valley was eroded to maturity with a more youthful trench in the bottom. Whether any glaciation earlier than Illinoian affected the valley is not known, but some drainage modifications connected with Killbuck are earlier. Illinoian left unmistakable records. The main ice sheet, perhaps as a sort of Black River lobe sometimes called Killbuck lobe, pushed over the country nearly as far south as Millersburg and sent a valley dependency a few miles farther down Killbuck. The evidence that it reached about as far as Killbuck village is good, and three masses of drift still farther south decorating both sides suggest that it may have gone even farther.

After the tongue melted away Illinoian melt water, loaded with waste, flowed down the valley long enough to aggrade to the present gravel terrace tops. Then a reversal in the habit of the stream, brought about by the general clearance of ice over the divide to the north and the cessation of over-burden, made the stream a degrader and the modern trench was cut leaving scattered gravel-sand terraces. Relatively there has been vastly

more removal of the deposit here than in nearby valleys like that at Brinkhaven, filled with Wisconsin outwash.

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BIOLOGICAL SOCIOLOGY*

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We are met today to dedicate a splendid new building devoted primarily to the teaching of life sciences. Perhaps it is not inappropriate at such a time to review briefly the place of biology in the future of our civilization. It would be impossible to review all the past contributions of biology to medicine, to agriculture and to general culture, and I shall take it for granted that all of you have perspective concerning these relationships. However, we are living in a tense age when we have to search our souls and our minds in order to discover the mistakes of the past and direct our activities toward future objectives which we deem an advance over present accomplishments.

What has biology to offer us at such critical times? We may take it for granted that biologists will contribute further to the control of disease and the lengthening of the life span of the individual. Biology will also help us to cultivate finer crops, breed better domestic animals, and combat pests. It will also contribute materials to industry, as may be seen by the recent development of the plastics. But many are asking if this is all. Of what avail are new lives if they face torture and starvation, and new materials and inventions if they place power in the hands of ignorant, insane dictators. Is the "law of the jungle" the contribution of biology to struggling mankind on the brink of the collapse of civilization? Does the scientist stop with the provision of greater power and more gadgets which may be used alike for common good or common disaster?

* Address delivered at the dedication of the Life Science Building at Denison University, October 17, 1941.

Such questions are being asked, and some scientists find them difficult to answer. If such queries cannot be answered, should we bother to dedicate new buildings, devote hard-earned sums to scientific investigation, or instruct the coming generations in scientific knowledge?

Let me attempt to show you that there are more hopeful aspects. Some cynic has defined an optimist as one who thinks the future is uncertain. As scientific knowledge grows, we may predict future events with greater certainty, and to me the future seems better because of the action of certain biological forces and the probable truth of certain biological principles.

One such biological principle is cooperation. A comparison and correlation of cooperative systems should give us an understanding of this principle. I am particularly interested in the societies of insects which are marvellous examples of effective cooperation. Human and insect societies are merely special manifestations of the principle of cooperative group action.

Insects and men have societies which are similar in having division of labor, social coordination, repetition of social patterns, social development and evolution, social adaptation, the persistence of vestigial social traits after the loss of their function, and the natural selection of population units as a whole.

These analogues not only show a remarkable similarity between insect and human social systems, but in many instances they show a striking similarity to the attributes of the individual organism. Especially in the case of the insects, the parallelism between the organismic coordination and the social coordination is so complete that one may speak of the society as a supraorganism probably guided in its evolution by many factors that have also guided the evolution of the organism.

In spite of many common analogous attributes, human society shows fundamental differences from insect social organization and these must also be analyzed for a proper perspective. Among the insects we do not find outstanding development of intelligence or learning capacity. Social insects may be conditioned, but their ability in this respect does not separate them from their non-social relatives to the same degree that man is separated from his closest

living relatives. Also the quality of leadership has not developed commensurate with that found among men or even the higher vertebrates. Correlated with these generalizations, we find that human social evolution has taken place with great rapidity compared to the slow evolution of insect societies. In addition certain phases of human social behavior have no parallel in the insect society which lacks analogues to political government and law, police, educational institutions and religion.

Is there any basic reason for such differences? It seems to me that we know the fundamental explanation for such dissimilarities. Instead of the usual mechanism of heredity through genic patterns in the chromosomes which determines relatively stereotyped development by means of enzyme chains, the human species is the only organism which has developed a substitute mechanism for such biological heredity. Instead of repeating the social pattern of past generations through gene combinations, as seems to be the case for most insect social behavior, man has symbolized his experiences by means of language, pictures and diagrams, and transmits these symbols through talk, writing, drawing, photography, printing, telegraph, telephone and radio, not only to his immediate associates, but to all parts of the world and to all succeeding generations. Thus our social patterns are repeated without involving the germ plasm and we do not need to wait for genes to undergo favorable mutation and for the slow process of natural selection to sort out beneficial gene effects. Through our enlarged capacity for conditioned behavior, we have discovered a new mechanism of evolution producing rapid and complex social changes and at the same time conserving the successful patterns of past generations. However, conditioning takes time and we are dependent upon a long individual life cycle and a long individual process of learning. We are socially more versatile than the insects and less sterotyped and automatic, but we are less perfectly coordinated. Each human must spend a third of his life or more acquiring certain effective social traits. We must also train a large proportion of our population as specialists functioning mainly as social integrators. Even then, we must spend much of our energy caring for temporary or per-

manently socially inadequate individuals. What is far worse, our world social organization has progressed far enough for mutual interdependence, but not far enough to avoid destructive national and class competition, so that we find ourselves in a transitional phase of human evolution in which the colossal mistakes and lack of vision of our electorate and politicians are only matched by our stupendous ignorance of basic social mechanisms and a lack of understanding which would assist in the solution of our social ills. One wonders whether blood, toil, tears and sweat are the only price to be paid for our errors. Natural selection of germinal factors over long periods of time has eliminated or prevented the rise of any inefficient intraspecific warlike behavior among social insects. In time it would seem that natural selection of hereditary symbolic patterns would also eliminate inefficient national and class competition in the human species and direct our aggressions into more constructive channels.

The development of human social heredity through learned language symbols is of such importance that this human attribute would seem to indicate the valid division line between the social and biological sciences. It is what the sociologist means when he says that man is unique in the possession of a culture. However, even though techniques may differ and phenomena are diverse in numerous instances, I personally believe that scientific methodology is fundamentally the same whether applied to human social mechanisms or insect social mechanisms, or whether applied to the social supraorganism or to the individual organism. In spite of the real differences between the societal types, careful comparison and correlation leads us to the formulation of important principles.

Let us return to the social similarities between insects and men and penetrate a little further in our search for causative factors. Why have such different organisms separately evolved division of labor, societal integration and the reproduction of social patterns? Why do these properties show parallels to the properties of organisms? What forces influence the origin and development of such complex living systems?

Darwin attempted to explain evolution by showing that there

was competition for limited necessities (overproduction), variation along many lines, hereditary repetition of the variations, a struggle for existence among the variants, and a survival of the fittest in the particular environmental situation. Thus natural selection guided evolution into adaptive channels. Modern ecology has begun the analysis of the environment and has shown that the environment fluctuates and varies as well as the organism. Often these variations are related and the organism varies directly with the environment, thus indicating a cause and effect relationship between the organism and the environment. Environmental fluctuations are such that they become limiting factors in the distribution of organisms and all organisms do not live in all environments. Organisms not only reproduce themselves but they capture, utilize and store energy from the environment, defend themselves against various predators and parasites, and maintain themselves in the environment to which they are adjusted. This necessity for maintaining ecological position is seen particularly in the myriad adaptations for attachment and locomotion. Ecological position not only places the organism in a relatively uniform physical environment, but also maintains access to a relatively stable source of food, a relative security from enemies and a relative accessibility of mates. The most primitive organisms seem to have evolved in naturally uniform physical and chemical environments with accessible necessities for life such as light, minerals and food. Such conditions are found on tropical sea shores. Competition within such favorable habitats, however, influenced selection of more efficient adaptations to the physico-chemical environment and also to the living community relations which developed. In addition, adaptive radiation from such environments has occurred in all the main plant and animal stocks and the organisms exploited new and often less favorable environments. Most often adaptive radiation occurred through an internal control over an external fluctuation. Protoplasm maintained a relatively constant composition of water, ions and metabolic materials in the face of environmental fluctuations of these substances. The naked cell, however, lived in less optimal conditions than did the cell in a group. Through division of

labor and coordination between cells, the external environment of the single-celled organism became the internal environment of the multicellular organism. The evolution of the controlled cellular environment has reached a truly astonishing development of stable physiological equilibrium and controlled periodicity in the higher animals and plants. Through such evolution, organisms successfully competed with less well organized primitive types and invaded environmental niches formerly closed to them. Water content could be controlled in the driest deserts and temperature could be controlled in the frigid zones.

In spite of such successful evolution, however, there were still fluctuations in the external environment of the multicellular organism that seriously limited its existence. Aggregating forms could bring the external environment under partial control. Two trends of evolution emerged in the development of greater living efficiency of means of natural selection. Ecological communities developed with interspecific patterns of relationship to the environment which correlate with a partial environmental control and a relative environmental stability for the individual organisms. In addition to this type of organization, a second evolutionary trend directed the development of intraspecific population groups and progressed toward greater and greater control of an otherwise fluctuating external environment. Sexual adjustments brought a balance between hereditary conservativism and variation. Reproductive adaptations tended to control the environment of the young during early developmental stages (i.e., the egg and the uterus). Familial organization controlled the environment during the later stages of development (i.e., nests, parental feeding, parental defense) and the family as a biological unit of great importance became established. Selection in these cases was not working alone upon the individual organism. The population became the unit of selection, much as the population of cells composing the multicellular individual has been selected as a coordinated unit. A logical explanation of the evolution of such familial adaptations as mammary glands is impossible by means of natural selection of individually fit organisms. The family unit thus is seen to have attributes of the organism for

the simple reason that the basic factors guiding familial evolution were similar to those guiding the integration of the organism. Regardless of how one interprets the unity of the more complex human societies, the human family together with mammalian, avian and other vertebrate and invertebrate family systems are real cooperative supraorganismic entities coordinated by similar biological mechanisms and forces.

But the end was not reached in the family organization. More complex units could more thoroughly control the external environmental fluctuations. Nests and shelters could be made more adequate through the cooperation of many specialists, enemies could be more successfully repulsed, food could be brought under cultivation (i.e., in fungus-growing colonies of insects and in human agriculture), reproduction could be more adequately adjusted to the population needs, hostile environments could be invaded which were otherwise unexploitable. Men and insects have accomplished these feats through societal systems, and the fundamental forces which have guided social evolution have some identity even though the germinal stocks are widely divergent.

Competition plays a tremendously important role in evolution, but the survival of the fittest does not necessarily mean the survival of the strong, the predators, the parasites or even the adequately defended organism. Fitness may mean cooperation for mutual benefit both between species and within integrated intraspecific populations as well as between parts of the organism. Cooperation is not an end in itself, but is the means to the end. The end would seem to be the control of the environment by bringing it closer to the optimal point for the organism concerned. The optimum, with our present knowledge of physiology and ecology, is often a rough approximation. Optimal conditions at one stage of development are not optimal at other stages. The optimum for one organismic function is not necessarily the same for the other functions. There are regular and irregular cycles both in the organism, supraorganism and environment which are reflected in periodic phenomena, special adjustments and a compromise or balance between complex and sometimes antagonistic forces.

Biological entities exhibiting such balanced equilibrium include the cells, multicellular organisms, colonies, species, aggregated populations, sex pairs, family units, social groupings and ecological communities. Society is surely a manifestation of fundamental life attributes which are shared with other biological systems and the division between the social and non-social is not sharp.

Also just as the internal controlled environment of the organism is exploited by parasites, social parasites have arisen to exploit the social environment. Just as numerous animal and plant species are incorporated into human society, the social insect colony is an interspecific ecological community consisting of numerous species of plants and animals adjusted both parasitically and symbiotically to the internal environment of the supraorganism. We have reason to think that the termite community was basicly a functional adjustment promoting an efficient cooperation between wood-eating insects and their symbiotic cellulose-digesting intestinal protozoa. In order that the molted individual could become reinfected with protozoa it was necessary for such an individual to live in a family or social community. It may thus be seen that the line between the social system and the ecological community is also not sharp.

Both intraspecific and interspecific cooperation is demonstrably an important biological principle, and animal and human societies are cooperative systems selected as they fulfilled organismic needs with greater efficiency. "United we stand; divided we fall" is an adage with true biological as well as sociological implications. Variation toward more efficient functions is shown again to be the basis of natural selection and progressive evolution.

The difference in the nature of the mechanisms for perpetuating and repeating social patterns in insects and men obviously influence the characteristics of these analogous societies. The coordinating factors in insect society are close to the physiological level. We have found that such agents as coenzymes passed from one individual to another through physical contact are probably parts of the enzyme chains which activate or inhibit growth and behavior processes among the social insects. The soldier termite differs radically in both form and behavior from the queen or

worker in spite of identical hereditary gene arrangements in the chromosomes. Such differences in all probability are the result of differing physico-chemical thresholds during development. "Social hormones" thus integrate the social pattern in much the same manner that the hormones integrate the individual pattern of the vertebrate organism. Regardless of the advertisements of the perfumers, soap manufacturers and cosmetic corporations, I doubt if the sociologists would assign great importance to chemical agents as integrating factors in human society. There is a story of a woman who spent a hundred dollars on various lotions only to find that people did not like her anyway.

With the shift from the germinal and physiological factors which obviously coordinate the organism and social supraorganism in the biological world to the social heredity through learned symbols in the human world, we find that we have arrived at an ethical system. Ethical patterns as coordinating factors in human society have their parallel in the physiological integrating factors of the organism and social insect supraorganism.

There are those who maintain that science stops when values are involved. A science of ethics would be a contradiction according to this dichotomy. When viewed from a functional and evolutionary viewpoint, however, we find analogues to human ethics in biological systems which are being studied by scientific methods and techniques. I, for one, see no reason why scientific method may not be applied to the study of social coordinating factors in human society. Although this field of science is certainly in its infancy, it would seem to be a rich subject for scientific investigation and fertile to the growth of an understanding of human society. There is a growing literature indicating a developing awareness of such relationships.

Of what value are such generalizations concerning correlations between human and insect societies? Significant relationships between diverse phenomena indicate more universal and thus more fundamental principles, thereby enabling us to arrange social attributes in a more logical and scientific order. Chronological order may help us to detect causative factors more easily and to predict events with greater accuracy. Social perspective

and understanding will grow. Social control based upon the practical application of our knowledge of social mechanisms will be nearer. For these reasons, I recommend a closer reciprocal understanding between the social and biological sciences, especially when correlated phenomena are under investigation.

Although I am here advocating a greater comprehension of social phenomena through scientific methodology applied to comparative sociology and to borderline fields between the biological and social sciences, I do not wish to leave the impression that intellectual understanding is the complete solution. We all inherit and develop emotional responses that are an important aspect of our lives and, like intellect, may be modified by experience and trained toward richer and more harmonious expression. It seems fairly obvious that "emotional discoveries and principles" often precede intellectual and scientific discovery. It has been said that thinking is hard work while prejudice is a pleasure. Scientists seem to get a lot of pleasure from their prejudice in favor of logical thought, but they should not overlook the place of emotional force and harmony even in science. I should leave a large place for the humanities and esthetics in social evolution, and I think cooperation between science and art is better than competition. Because of the infinite complexity of social phenomena, I have no illusions that a perfect understanding is possible, but a small approach toward such an understanding—with emotion and intellect well balanced—is both possible and probable, and I can imagine no evolutionary development of greater influence upon future civilization.

To me this prospect brings hope in the face of the present struggle, and I feel that science working cooperatively with other aspects of human civilization will ultimately raise us out of our present dark age. May the activities within your institution and your new building assist in this process!

THE LIFE SCIENCE BUILDING AT DENISON UNIVERSITY

ARTHUR WARD LINDSEY

Received November 25, 1941; published January 26, 1942

The new life science building (Fig. 1) presented to Denison University by Miss Ida Frances Doane is a three story Georgian structure with additional finished space in the basement and attic. The building will house permanently the departments of biological sciences and psychology, and for the present also the departments of philosophy and sociology. A large basement room houses the Carnegie music collection and is used for Conservatory classes.

The facilities for biology and psychology are widely distributed in the building, hence a survey floor by floor is the most convenient way of considering them. A tile-lined animal room occupies the entire east end of the attic, adjoining an animal experimentation room where ample floor space for large mazes is available. The central part of this floor is given over to a greenhouse, tile lined and brick floored. In it ample benches, pot racks, soil bins and propagating beds are provided, and in addition to these normal facilities, two tanks for hydroponics and a battery of lights over one of the benches. The west end of the floor contains two rooms at present used by the Conservatory of Music. Two small rooms on the north are assigned to students for special work.

The south half of the third floor is occupied entirely by psychology. From east to west the rooms are a large classroom, seating fifty students, a smaller room seating twenty-five, a testing room, a group of four experimental cubicles, and a large laboratory. The northwest corner is occupied by a bacteriology laboratory equipped with all necessary apparatus including sterilizers, ovens, refrigerator and abundant glassware. The room has chemistry type tables seating sixteen students, and a wall table along the lighted end and side for general use. A similar room for histology

NEW LIFE SCIENCE BUILDING DEDICATED OCTOBER 17, 1941

Fig. 1

in the northeast corner has places for twenty-four students, and a wall table along the lighted side for general use. This laboratory is equipped with paraffin baths, Spencer slide and rotary microtomes, and a generous supply of smaller items of equipment. Both of these laboratories have adjoining storerooms. They share the use of twenty-five new Bausch and Lomb medical microscopes. The one remaining room on this floor is furnished with table and chairs to serve as a seminar room.

On the second floor an introductory biology laboratory occupies the entire west end. Four large trapezoidal tables provide places for forty students. Each place is provided with six drawers, so that six sections of this size can be accommodated. Thus each student can have a small independent space for his individual possessions. Wall cases are available for microscopes and models, and a storeroom for other general equipment and supplies. An instructor's desk is flanked by an aquarium and a table for materials.

A similar room at the opposite end of the floor is the comparative anatomy laboratory, furnished with thirty small tables and an instructor's desk. Wall cases accommodate an abundant collection of skeletal material and a storeroom cares for other supplies. In it two large lead-lined tanks with water and drain connections are used for storing the specimens in use by the class. Metal racks for the specimens and the covers of the tanks are suspended from light chain hoists by which they can be lifted to drain before laboratory periods. A feature of this laboratory is the provision of two sinks, with racks for dissecting pans, flanking the entrance. This arrangement permits the large class to clean up with minimum congestion at the end of its laboratory periods.

A museum on the south side of this floor is equipped with three steel herbarium cases and two large steel insect cabinets containing 196 National Museum style drawers. Wall cases, partly with sliding glass doors, occupy two of the inside walls. These cases accommodate teaching collections of preserved specimens. The south wall has a long work table with sink, cupboards, and drawers, between the two windows. The remainder of the south exposure is occupied by three offices for the psychology department, opening on a common vestibule, and by one office (with a laboratory table across the outer wall) for biology. A room on

the north side of the hall, furnished with table and chairs, is at present designated as a faculty men's room.

The east end of the main floor is divided between a large biology classroom and a room of equal size furnished with laboratory tables of simple design, arranged so that the room can be used either for class or for laboratory purposes. Adjoining it a small chartroom accommodates the departmental collection of charts. A small reading room on the north side of the building faces the main entrance across a spacious lobby, which is flanked by two offices with laboratory facilities for members of the staff. At the west end of this floor is an assembly room seating 174. A large lecture desk here is provided with gas, water and electrical outlets and with switches governing the entire lighting system and signals to the projection booth. Blackboard space, a projection screen and chart racks are available. The projection booth is equipped with a 16 mm. Bell and Howell sound projector and is to have a projector for 3.25″ x 4″ or 2″ x 2″ slides. The assembly room is lined with teak, while the corridor and reading room are panelled in oak. The windows in these rooms are provided with attractive drapes.

The entire front or south half of the basement is below grade, and is given over to a meter room, workshop, dark room, soundproof room and storage room. The north side, almost entirely above grade, contains sociology and philosophy offices and classrooms and the music room already mentioned.

In the corridors of the first, second and third floors display cases are built into the walls. Those of the two upper floors are recessed and are provided with adjustable brackets, glass shelves, and sliding glass doors. The two cases on the first floor flank the entrance to the reading room and are part of a plain but beautifully designed bronze and glass assembly including the doors to the room itself. The cases are square and high, with adjustable shelf brackets, glass shelves, and a mirror back. They open from the reading room and their contents are visible either from it or from the corridor.

The construction of the building is fireproof throughout and its design provides convenient and inspiring surroundings for the work of the several departments, with reasonable allowance for expansion.

DENISON SCIENTIFIC ASSOCIATION

Organized April 16, 1887

REPORT OF THE PERMANENT SECRETARY FOR THE YEAR 1940–1941

Officers serving the Association during the college year 1940–1941 were:

F. B. Wiley, *President*
L. C. Steckle, *Vice-President*
C. S. Ades, *Recording Secretary and Treasurer*
W. C. Ebaugh, *Permanent Secretary and Editor*
L. E. Smith, *Librarian*

In accordance with its usual custom meetings were held in the Physics Lecture Room of Barney Science Hall, with the exception of the final session, a dinner meeting at the Granville Inn. A summary follows:

October 8, 1940

WHAT IS YOUR ALLERGY? George D. Morgan.

Hay fever, asthma, sinusitis, migraine, gastro-intestinal disturbances, eczema and many other ills to which flesh is heir may be due to allergy. Wonderful progress has been made recently in combating such diseases as penumonia with sulfanilamid and pernicious anaemia with liver extract. Diagnoses for allergies of various types, proposed palliatives or cures for these troubles, and prospects for the elimination of this very annoying class of diseases were presented.

October 22, 1940

(Meeting omitted because of ceremonies incident to the inauguration of Kenneth Irving Brown as President of Denison University.)

November 12, 1940

TREKKING ACROSS AFRICA. Henry F. Donner (Western Reserve University).

A resident of Bloemfontein, South Africa, for many years, the

speaker assisted in erecting the Lamont-Hussey Observatory of the University of Michigan and was a member of its staff engaged particularly in the search for new double stars. Some 1100 and more of them were discovered during that time. An illustrated account of journeys during vacation periods, and especially of a trip by automobile from south to north covering 10,000 miles and requiring four months time, gave a very real picture of the Africa of today. South Africa, the Sudan, and the Nile Valley with its adjacent deserts received special attention.

November 26, 1940

REACTIONS IN LIQUID AMMONIA. W. CONARD FERNELIUS (The Ohio State University).

Liquid ammonia, used extensively in refrigerating apparatus, boils at about minus 28° F. Employing it as a solvent instead of water, alcohol, hydrocarbons, etc., reactions can be brought about that do not occur under the ordinary conditions of experimentation. An entirely new field of chemistry is thereby opened up in which ammonia, NH_3, functions in an important role much as does water in ordinary chemical changes. The special techniques employed in working at such low temperatures with a material as disagreeable as ammonia, the theories underlying the experiments, and a showing of many of the compounds produced, afforded a splendid introduction to this comparatively new branch of chemistry.

December 10, 1940

THE BIOLOGY OF WAR. ARTHUR WARD LINDSEY.

Men think and talk about war at great length in terms of armaments and food supplies, of life and death, of political power and aims, and of love and hate, but the basic forces involved are not considered often. Life itself, and therefore all living things, are inexorable in their processes and are often ruthless, and war is thus one of the expressions of life. Fundamentally man is a solitary animal, and as such will fight to get food, to keep from becoming food for other animals, and to maintain life by mating, i. e., developing the family. But as in the case of social animals, such as certain insects like ants and bees, man joins to man for

concerted action to attain his ends; when carried to excess against his fellows this becomes war, and what is condemned as crime when done by an individual or small group is lauded as praiseworthy when perpetrated by a nation. At times of such stress, when emotional appeals rather than reason take command, the social animal instincts emerge in man. This problem is one man must master before he can reasonably expect to be done with war.

January 14, 1941

RECENT SENSATIONS IN PHYSICS. LEON E. SMITH.

Three recent developments discussed were (a) ultra-high frequency methods of analysis, (b) electron microscope, and (c) nucleus fission. It was pointed out that subatomic phenomena included such diverse topics as spectrum analysis (especially fine line spectra, the influence of motions of the nucleus and satellite electrons), the actions of powerful electric fields in causing particles to converge or diverge much as light may be controlled in an ordinary microscope, and the transformations of mass and energy involved in "smashing the atom" by using radio-active materials or the cyclotron. The addition of about 250 isotopes to our list during ten months in 1940, and the studies on Uranium-235 and its energy possibilities, were stressed.

February 11, 1941

SYMBOLIC LOGIC. EDWARD DEEDS.

Symbols or language and logic become simply a means and an end when the fundamental principles underlying human reasoning are studied. Of comparatively recent origin, symbolic logic has played a large part in the development of certain sciences from purely empirical studies to true sciences with a solid theoretical foundation. The basic concepts were outlined, and illustrations were worked out to show the spirit of the attack. Applications to psychology, biology, language, physics, and certain fine arts like music, were demonstrated.

February 25, 1941

SOME EXPERIMENTAL GAINS IN MENTAL HYGIENE. T. A. LEWIS.

Until lately "mental hygiene" was a charlatan's affair, with

quacks and fakirs competent to prescribe for the mentally deficient; today, however, the staff of a mental hospital has at its disposal a world of information based upon experimentally determined facts to help restore mental health by adjusting the patient to his whole world environment. Neuroses in animals developed under experimentally determined conditions, such as mazes, food searches, etc., have revealed much of value to the psychiatrist. Let the physician and clinical psychologist together investigate the patient, supplementing each other, make a survey of the causal factors involved, and then try to remove the cause of the maladjustment, bring about a cessation of the unfavorable impression upon the patient, and restore a master-motive to break a wrong habit and replace it by a new habit. Often a needed amount of emotional response must be stirred up to effect the cure of bad habits. Diagnostic facilities for getting a line on a maladjusted person have been improved and multiplied: these artifices are not yet fine enough to spy out maladjustment in its incipient stages.

March 11, 1941

THE TRUTH ABOUT CACTI AND SUCCULENTS. James Merry.

Succulent plants, juicy, fleshy and thick-leaved, form an artificial group in contradistinction to the natural classification into four groups based upon seed-bearing and leaf structures. For cacti in general a very characteristic factor is the areole or little patches upon the stems. Upon pricking the succulents a milky juice appears, but this is not so with true cacti; very few of them have a milky juice. Sixty or more plants were used to illustrate the topics presented.

March 25, 1941

TRAINING FOR TRAFFIC ENGINEERS. Fred C. Tarbox (Ohio State Highway Department).

In 1900 all highways were of an old type; in 1940 there are more than 30,000,000 motor vehicles, with at least 40,000,000 drivers and an unnumbered army of workers employed upon the 900,000 miles of highways in the United States—is it any wonder

that the need for highway design and construction, maintenance and regulation has become so great? With 34,400 fatalities (2,075 in Ohio) and 6,000,000 accidents a year recorded, traffic engineers are faced with problems of education, enforcement and engineering to promote a safer and more efficient use of our modern means of transportation. The development of public opinion, teaching individuals to do with skill the proper thing at the right time, maintaining a highway patrol to help in all traffic matters when and where needed, discovering and correlating data and making recommendations for improvements—suggestions that must be understandable by professional engineers and laymen alike—all come under the duties of the traffic engineer. Possibilities of employment are great, and some of the colleges offering training courses in this type of engineering were named.

April 22, 1941

THE RACIAL MAP OF EUROPE AS DRAWN TODAY.

FREDERICK G. DETWEILER.

What has become of the old Nordic-Alpine-Mediterranean analysis of Europe? Where have the present peoples of Europe come from? Who are the Finns, Ruthenians, Croats? Nowadays one thinks of these races not as geographic entities, but as peoples of certain group characteristics, ethnographic measurements, and racial traits, irrespective of their location. It is believed that the Neolithic peoples of perhaps 10,000 B.C. were a food-producing folk rather than hunters. Migrations carried them hither and yon, both by mass movements and by individual penetration of new territories. Civilization began with the Mediterranean peoples, who then went north by various routes to the east and west of that area. No two schools of anthropologists agree on details of racial characteristics as shown by indices for head, nose, feet, stature, hair, eyes, skin, face, etc. Races do not belong in any one spot, but are where you find them. Nor are racial types permanent: they change with environment or changing conditions.

May 12, 1941

(Dinner and business meeting at the Granville Inn.)

At the close of the college year Dr. Avery Albert Shaw retired from the presidency of Denison University, having completed a very successful term of thirteen years in that office. He was named President Emeritus. In common with all others connected with the institution, the Scientific Association extended to him its assurances of affection and good wishes for his future.

The Trustees of Denison University elected Kenneth Irving Brown, for ten years President of Hiram College, Hiram, Ohio, to the position vacated by Dr. Shaw. His ability as an educator, executive and stimulating leader in all that pertains to the conduct of affairs collegiate won for him very quickly a large place in the esteem of the constituency of Denison University.

At the inauguration exercises for President Brown, held October 18, 1940, the honorary degree of Doctor of Science was conferred upon Daniel Sheets Dye. The citation follows:

A modern Marco Polo departing from Denison's campus, flying "North to the Orient," barely missing the Pole, and then continuing his flight until he had gone about one-third the distance around the globe on his great circle course, would have found himself in West China. And there in Chengtu, on the campus of West China Union University, at almost any time during the last thirty years, he might have been greeted by a loyal son of Denison.

DANIEL SHEETS DYE, a native of Ohio, obtained his Bachelor of Science degree from Denison University in 1907, pursued graduate work at Wisconsin, Cornell, Columbia, and Pendle Hill, and was awarded his Master of Arts degree by Cornell in 1915. He is a charter member of Phi Beta Kappa at Denison, and was elected to Sigma Xi at Cornell.

When West China Union University was opened in 1910 our Denison friend joined its faculty, and ever since he has remained its physicist in spite of flattering offers of teaching positions in America. He is now Professor of Physics and Dean of the Science Department at that center of learning in West China, far beyond the Gorges of the Yangtze-kiang. Thousands of students and teachers, fleeing from schools destroyed or occupied by invading armies, have traveled towards Chengtu during these latter years, and have found there at least a temporary scholastic home.

At times a member of the governing boards of Nanking University and of his own West China Union University; a member of American, British and

Chinese learned societies; an author of numerous articles on geology, geography and physical geography, a laboratory manual of physics, book reviews and biographies; more recently awarded wide recognition because of a monumental two-volume work, beautifully illustrated, entitled *A Grammar of Chinese Lattice* in which are embodied results of his prolonged researches in the realms of Chinese art and archaeology—truly his life and labors merit our recognition.

Wherefore, Mr. President, on behalf of the Trustees and Faculty of Denison University, I now present to you DANIEL SHEETS DYE for the Honorary Degree of Doctor of Science.

The customary three numbers of the JOURNAL OF THE SCIENTIFIC LABORATORIES OF DENISON UNIVERSITY were published during the year, *viz.*:

Vol. XXXV, Article 3, pp. 55–137, August, 1940
- Relationships of the Family Allagecrinidae, with Description of New Species from Pennsylvanian Rocks of Oklahoma and Missouri; Raymond C. Moore. 83 pp., 14 figs., 2 plates.

Vol. XXXV, Articles 4–8, pp. 139–218, December, 1940
- Gas Amplification of Photo-electric Currents for High Values of E/P; Neil Edward Handel. 28 pp., 15 figs., 1 plate.
- Caney Conodonts of Upper Mississippian Age; E. B. Branson and M. G. Mehl. 12 pp., 1 plate.
- Conodonts from the Keokuk Formation; E. B. Branson and M. G. Mehl. 10 pp., 1 plate.
- A Record of Typical American Conodont Genera in Various Parts of Europe; E. B. Branson and M. G. Mehl. 6 pp., 1 plate.
- The Recognition and Interpretation of Mixed Conodont Faunas; E. B. Branson and M. G. Mehl. 15 pp.
- Report of the Permanent Secretary of the DENISON SCIENTIFIC ASSOCIATION. 8 pp.

Vol. XXXVI, Articles 1–3, pp. 1–66, April, 1941
- Tegminal Structure of the Pennsylvanian-Permian Crinoid *Delocrinus*; Raymond C. Moore and Harrell L. Strimple. 12 pp., 1 plate.
- Fluorescence and Fluorescent Lamps; W. E. Forsythe, B. T. Barnes and E. Q. Adams. 34 pp., 17 figs.
- Dakotasuchus Kingi, A Crocodile from the Dakota of Kansas; M. G. Mehl. 19 pp., 3 figs., 2 plates.

Our request for the return of old numbers of the JOURNAL is renewed, as there are gaps in the stock of some of these back issues and the only way exchanges and new subscribers can be supplied is through the use of returned copies.

An outstanding event of the year was the razing of Marsh Hall, the oldest building on Denison's campus and long used as a

dormitory, and the construction of a magnificent Life Science Building to house the Departments of Biology (including botany, bacteriology and zoology) and Psychology and to afford temporary space for certain other Departments. With geology and physics cared for in Barney Science Hall (1894), astronomy in Swasey Observatory (1909), and chemistry in Chemistry Cottage (1925), all science departments are now provided with excellent quarters for undergraduate work. A description of the new building will be found elsewhere (p. 156) in this issue of the JOURNAL.

Simple ceremonies marked the dedication of the Life Science Building on Friday, October 17, 1941. A copy of the program follows:

(Editor's Note.—Although an account of the dedication of the Life Science Building belongs properly in the Report of the Permanent Secretary for the college year 1941–1942, it is inserted at this point because of its timeliness.)

DEDICATION

OF THE

Life Science Building

Denison University

FRIDAY, OCTOBER SEVENTEENTH

10:00 A.M.

1941

CEREMONY OF UNVEILING

PLAQUE OF DEDICATION

Foyer of Life Science Building

10:00 A.M.

☼ ☼ ☼

EXPRESSION OF APPRECIATION FOR THE DONOR'S GENEROSITY
Clifford S. Stilwell,
Chairman of the Board of Trustees

UNVEILING OF THE PLAQUE
Kenneth I. Brown,
President of the University

PRAYER
Millard Brelsford,
Secretary of the Board of Trustees

. . . . .

"LIFE SCIENCE BUILDING, DEDICATED 1941, THE GIFT OF IDA FRANCES DOANE, DAUGHTER OF WILLIAM HOWARD DOANE, TRUSTEE AND BENEFACTOR OF DENISON UNIVERSITY, 1874–1915."

DEDICATION SERVICE

Swasey Chapel, 10:30 A.M.

President Kenneth I. Brown, presiding

☼ ☼ ☼

ORGAN PRELUDE

"Gloria Domini" .... *T. Tertius Noble*

Brayton Stark, University Organist

INVOCATION

Reverend T. F. Chambers, D.D.
Member of the Board of Trustees

ANNOUNCEMENT OF THE PURPOSE OF THE DAY

EXPRESSIONS OF APPRECIATION

Clifford S. Stilwell,
Chairman of the Board of Trustees

A STATEMENT OF PLANS FOR THE USE OF THE LIFE SCIENCE BUILDING

Arthur W. Lindsey,
Professor of Biological Sciences

FORMAL ACCEPTANCE OF THE LIFE SCIENCE BUILDING

Franklin G. Smith,
Chairman of the Buildings and Grounds Committee
of the Board of Trustees

MUSIC

"Credo" .... *Gretchaninof*

The A Cappella Choir

INTRODUCTION OF SPEAKER

ADDRESS

Alfred Edwards Emerson, Professor of Zoology,
The University of Chicago

BENEDICTION

Reverend Warren P. Behan, D.D.,
Acting Minister of the Granville Baptist Church

ORGAN POSTLUDE

"Fugue in E flat" .... *Bach*

THE ARCHITECT

William Gehron

THE CONTRACTORS

Mr. Wheeler, president, Frank Messer & Sons
Mr. Oelgoetz, president, J. F. Oelgoetz Company
Mr. Hartman, Electric Power Equipment Company
Mr. Johnson, E. H. Sheldon and Company
Mr. Kinney, Engineer, Cincinnati

An interesting newspaper account of the event appearing in the Columbus, Ohio, *Dispatch* of October 19, 1941, gave additional information concerning the donor and her father, William Howard Doane. It is reproduced herewith:

THE COLUMBUS DISPATCH

Sunday, October 19, 1941

Denison Dedicates New Building, Fifth Donated by Doane Family

☼ ☼ ☼

$300,000 Life Science Hall Is Ultra Modern

GRANVILLE, OHIO, OCT. 18.—Denison University paid tribute Friday to Miss Ida Frances Doane, South Orange, N. J., as a plaque was unveiled, revealing her as the donor of the new Life Science building costing $300,000.

This four-story Georgian style structure is the fifth to be directly associated with the benefactions of the Doane family to Denison University. Miss Doane's generosity was acknowledged by President Kenneth I. Brown.

Dr. Alfred Edwards Emerson, professor of zoology at the University of Chicago, gave the dedicatory address.

Provided with 12 laboratories, four classrooms, two seminar rooms besides several special features for the departments of biological sciences and psychology, the building is one of the finest in any small college in the United States. It has been in use since the opening of the college year.

STUDENTS in biology, bacteriology, comparative anatomy, histology and psychology have the most up-to-date laboratory equipment available. Special features include small individual experimental laboratories, a greenhouse on the top floor, a museum for the display of herbariums, collections of insects and the like, and a room for visual instruction.

Architecturally, the assembly room has few peers. Its solidly paneled teakwood walls, its lighting fixtures and draperies and its sound-proof construction make it beautiful as well as utilitarian. It seats 175. Almost as striking is the oak paneling in the lobby. Other rooms attractively furnished are the reading room and music appreciation room.

ALREADY three buildings on the campus bear the name of the donor's father, William Howard Doane, who died in 1915. They are Doane hall, serving as the administration building and known as Doane academy from 1892 to 1927; Doane gymnasium for women, erected in 1905, and William Howard Doane Memorial library, built in 1937 to replace Doane library, 1878–1936.

Mr. Doane during the post-Civil war period was actively engaged in the manufacture of woodworking machinery at Cincinnati. He gained some reputation as an inventor but was widely known as a composer of sacred music.

Among hundreds of hymns, his best known ones are "Safe in the Arms of Jesus," "Tell Me the Old, Old Story," "Rescue the Perishing," "Precious Name, O How Sweet" and "Draw Me Nearer."

The serious effects of war and preparations for war upon scientific activity of the usual type are illustrated in the falling off of publications, both domestic and foreign. With defense work calling for the time and energy of so many scientists, it is not surprising that matter for publication is not forthcoming. And with the hazards of transportation on the oceans facing our various Exchange Services, *e.g.*, The International Exchange Service of the Smithsonian Institution in our own country, they are justified in declining to handle shipments until something like sanity and reason are restored to this troubled world. We ourselves are saving all issues of our JOURNAL destined for our foreign exchanges until communications are restored and we can be assured that delivery to the various universities, libraries, institutions of technology, academies and societies can be made.

Respectfully submitted,

W. C. EBAUGH, *Permanent Secretary and Editor*

SUBJECT AND AUTHOR INDEX

4
1
XU

Some suggested experiments for the graphic recording of speech vibrations; Robert James Kellogg. 14 pp., 6 figs.
The manipulation of the telescopic alidade in geologic mapping; Kirtley F. Mather. 46 pp., 13 figs.
The importance of drainage area in estimating the possibilities of petroleum production from an anticlinal structure; Kirtley F. Mather and Maurice G. Mehl. 4 pp., 2 plates.

Articles 9-12, pp. 147-224; May, 1920 .... $0.75
Psychological factors in vocational guidance; Thomas A. Lewis. 10 pp.
The use of models in the interpretation of data for determining the structure of bedded rocks; Maurice G. Mehl. 12 pp., 6 figs., 2 plates.
Some suggestions for indicating drilling operations; Maurice G. Mehl. 6 pp., 3 figs.
The Kimmswick and Plattin limestones of Northeastern Missouri; Aug. F. Foerste. 50 pp., 3 plates.

Articles 13-16, pp. 225-329; September, 1921 .... $0.75
Education for scholarship; William E. Castle. 9 pp.
The cytology of the sea-side earwig, Anisolabis maritima Bon., part 1; Sidney I. Kornhauser. 13 pp., 3 plates.
Notes on Arctic Ordovician and Silurian cephalopods; Aug. F. Foerste. 60 pp., 9 plates.
Revolution vs. evolution: the paleontologist renders his verdict; Kirtley F. Mather. 18 pp.

VOLUME 20

Articles 1-3, pp. 1-36; November, 1922 .... $0.50
A review of the biology of sex-determination; Sidney I. Kornhauser. 21 pp., 8 figs.
The Meander patterns of Rios Securé and Mamoré, Eastern Bolivia; Kirtley F. Mather. 7 pp., 2 figs.
Primitive musical instruments of the Denison Collection; Karl H. Eschman. 10 pp., 3 plates.

Articles 4-8, pp. 37-186; June, 1923 .... $0.75
Notes on Medinan, Niagaran, and Chester fossils; Aug. F. Foerste. 84 pp., 13 plates.
The egg and larvae of Hesperia juba Bdv.; A. W. Lindsey. 7 pp., 1 plate.
The occultation of Venus by the Moon on January 13, 1923; P. Biefeld. 4 pp., 1 plate.
A botanical survey of the campus of Denison University; Dwight Munson Moore. 23 pp., 7 figs., 3 plates.
The underground migration of oil and gas; Kirtley F. Mather. 31 pp., 1 fig.

Articles 9-13, pp. 187-383; December, 1924 .... $1.25
Trichoptilus pygmaeus Wism. and the Neuration of the Family Pterophoridae; A. W. Lindsey. 6 pp., 6 plates.
Notes on American Paleozic Cephalopods; Aug. F. Foerste. 76 pp., 22 plates.
A Report on the Theory of Relativity (Einstein Theory); Paul Biefeld. 20 pp.
Some Problems of Taxonomy; A. W. Lindsey. 18 pp., 1 plate.
Notes on the Geology of Giles County, Virginia; George D. Hubbard and Carey G. Croneis. 72 pp., 1 plate.

VOLUME 21

Articles 1-3, pp. 1-116; March, 1925 .... $1.25
Notes on Cephalopod Genera; Chiefly Coiled Silurian Forms; Aug. F. Foerste. 70 pp., 23 plates.
The Cornell University Entomological Expedition South America of 1919-1920. Scientific Results No. II. Hesperiodea; A. W. Lindsey. 44 pp., 6 plates.
Photographic Record of the Partial Solar Eclipse of January 24, 1925; Paul Biefeld. 2 pp., 1 plate.

Article 4, pp. 117-283; September, 1925 .... $1.50
The Agricultural Geography of the Salt Lake Oasis; Charles Langdon White. 167 pp., 34 figs.

Articles 5-7, pp. 285-404; September, 1926 .... $1.25
Actinosiphonate, Trochoceroid and other Cephalopods; Aug. F. Foerste. 100 pp., 22 plates.
Brachiopods from the St. Clair Limestone, Arkansas: Norman L. Thomas. 18 pp., 1 plate.
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